Using WRF-ARW in Operational Forecasts

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WRF-ARW has been used in realtime in Shanxi province as one of its daily operational weather forecast tools since October 2005. The realtime WRF forecast system uses a grid configuration of 45/15/5-km horizontal resolutions, and 30 vertical model layers, with the 5-km grid covering the entire Shanxi province. It produces forecasts up to 48-72 hours twice a day (00 UTC and 12 UTC) and is initialized using the National Center for Environmental Prediction (NCEP) global forecast system (GFS) data as initial and lateral boundary condition. No dada assimilations are applied. The sea surface temperature (SST) field is based on Realtime Global SST (RTG-SST) also available from NCEP, and snow cover data is based on GFS. The WRF Standard Initialization (SI) is used in the preparing the model initial and boundary conditions. The following model physics are used on all model domains: 1) WSM 3-class simple ice scheme for microphysics; 2) RRTM longwave and Dudhia shortwave for atmospheric radiation; 3) Mellor-Yamada-Janjic (MYJ) TKE scheme for planetary boundary layer (PBL), along with Monin-Obukhov scheme for surface layer and thermal diffusion scheme for the surface physics; 4) No cumulus parameterization scheme (CPS) is applied on the 5-km grid, but Kain-Fritch (KF) is applied on the 45- and 15-km grids; 5) no land-surface schemes are used.

Model verifications (based on 10 representative weather stations) during a period of over 1.5 years indicated that WRF-ARW overall is a good model which is able to produce realistic meteorological fields required for our operational forecast, including surface temperature, precipitation amount and precipitation patterns, and wind speed and direction. It was found that WRF-ARW has a good skill in predicting precipitation, especially the convective precipitation in summer time which implies that KF CPS is a good scheme to use in mid-latitude regions like Shanxi province. The 15-km grid

has the best precipitation forecast. However, the WRF-predicted surface temperature always shows a cold bias in the low temperature and a relatively weak warm bias in the high temperature. This appears to indicate that the MYJ PBL scheme may need to be improved in terms of forecasting temperature field (or a better PBL scheme is desired when it is available in the future). This WRF-Workshop presentation is intended to provide feedbacks to the WRF developers by presenting some of our model verification results which are hopefully useful for further improving the WRF model.